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On the Dispersion of *Homo sapiens* in Eastern Indonesia: The Palaeolithic of South Sulawesi¹

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Thiel (CA 28:236–41) has proposed that the dispersion of *Homo sapiens* throughout eastern Indonesia and beyond, into Australia, during Upper Pleistocene times may be explained by migration during periods of high sea level, as reduction in land area increased pressure on existing food supplies and compelled people to search for new land. She suggests that probably nowhere in the eastern islands, which have always been separated from former Sundaland by deep straits, will there be any evidence of human occupation earlier than about 50,000 B.P., when there was a distinct rise in sea level. In our opinion, the earliest traces of human occupation in South Sulawesi may indeed date from around 50,000 B.P. *H. erectus* evidently never reached South Sulawesi, and the ancient stone implements that have been collected in the Walanae Valley during the past two decades must be attributed to *H. sapiens*. We think that Thiel has provided a very useful working hypothesis on the basis of which it will be possible to consider the evidence from other islands in the eastern Indonesian archipelago.

The four-armed island of Sulawesi extends across the equator from 2° N to 6° S. It is about 800 km long and 500 km at its widest point (fig. 1). Its geology is rather complicated because of its location between the Asian and Australian continents. During the Tertiary Sulawesi was a string of islands that gradually merged as a result of epeirogenetic movements, volcanic eruptions, and

erosion of mountains the detritus of which was deposited in the littoral zones. In the Miocene and again in the Plio/Pleistocene, the existing deposits were folded, and pronounced fault systems came into existence.

The terrestrial faunas of the western and the eastern Indonesian archipelago have long been recognized as distinct. In the middle of the last century the naturalist Wallace drew a line between Bali and Lombok and between Borneo and Sulawesi to indicate a barrier between an Asian fauna, with an abundance of mammals such as apes, monkeys, rhinoceroses, elephants, tapirs, etc., and an Australian fauna, with nonplacental mammals such as marsupials and monotremes. Geologically, Wallace's Line seems well founded. The Strait of Makasar is nearly 3,000 m deep and was probably never narrower than 150 km during the Pleistocene. The Lombok Strait was still in existence, and accordingly it was assumed that terrestrial mammals could not have crossed Wallace's Line. The islands of Sumatra, Borneo, and Java are situated on the submarine platform called Sundaland, a direct continuation of the Asian mainland. When the shallow sea ran dry during Pleistocene periods of low sea level, Asian terrestrial mammals, including *H. erectus*, could have reached all the islands west of Wallace's Line, although other dispersal routes could be envisaged (Braches and Shutler 1984). Sulawesi, however, seemed to have been unattainable.

At the beginning of this century it became clear, however, that Wallace's Line was not to be regarded as an absolute barrier. As more information became available about the contemporary fauna of Sulawesi, it was recognized that more than 50% of the vertebrates and invertebrates were of Asian origin. A land bridge must once have existed between South China, via Taiwan and the Philippines, and North Sulawesi. Wallace's Line came to be viewed as a vague boundary between a rich Oriental fauna in the west and an impoverished, unbalanced, endemic one on the eastern islands. Cave research on Sulawesi yielded no extinct species but many interesting endemic forms. Therefore, it came as a surprise in the late 1940s when a true fossil vertebrate fauna including elephant remains was found there, and the question immediately arose whether early hominids in the form of *H. erectus* could have reached the island.

The vertebrate fossils were discovered in the south arm of Sulawesi in the area south of Lake Tempe (fig. 1). The first fragments were found in 1947 by H. R. van Heekeren, at that time a prehistorian with the Archaeological Service of the Dutch East Indies. The fossils were subsequently described by Hooijer (e.g., 1948). This fossil fauna has become known as the *Archidiskodon-Celebochoerus* fauna and is characterized by curious endemic forms such as giant tortoises and dwarf elephants. The habitat of these species was clearly insular, and geological investigations confirm that South Sulawesi south of Lake Tempe was a separate island during the Miocene and Pliocene and much of Pleistocene. It is unnecessary, however, to postulate land bridges to account for the arrival of the *Archidiskodon-*

1. We thank R. P. Soejono and S. Sartono for enlightening discussions on the artifacts and fossils from the Walanae Valley. The artifacts will be considered in more detail in a subsequent paper (Keates and Bartstra n.d.). For critical comments on this manuscript H. Veenstra and R. Shutler, Jr., deserve our gratitude. Also, we thank T. van Heekeren for presenting us with notes of his late father and J. C. Olivier for giving us some old letters that have elucidated the circumstances of the very first finds. Finally, we wish to mention Pak Anwar Abdoel Kadir of Berru, who guided us to the various sites with unflinching dedication.

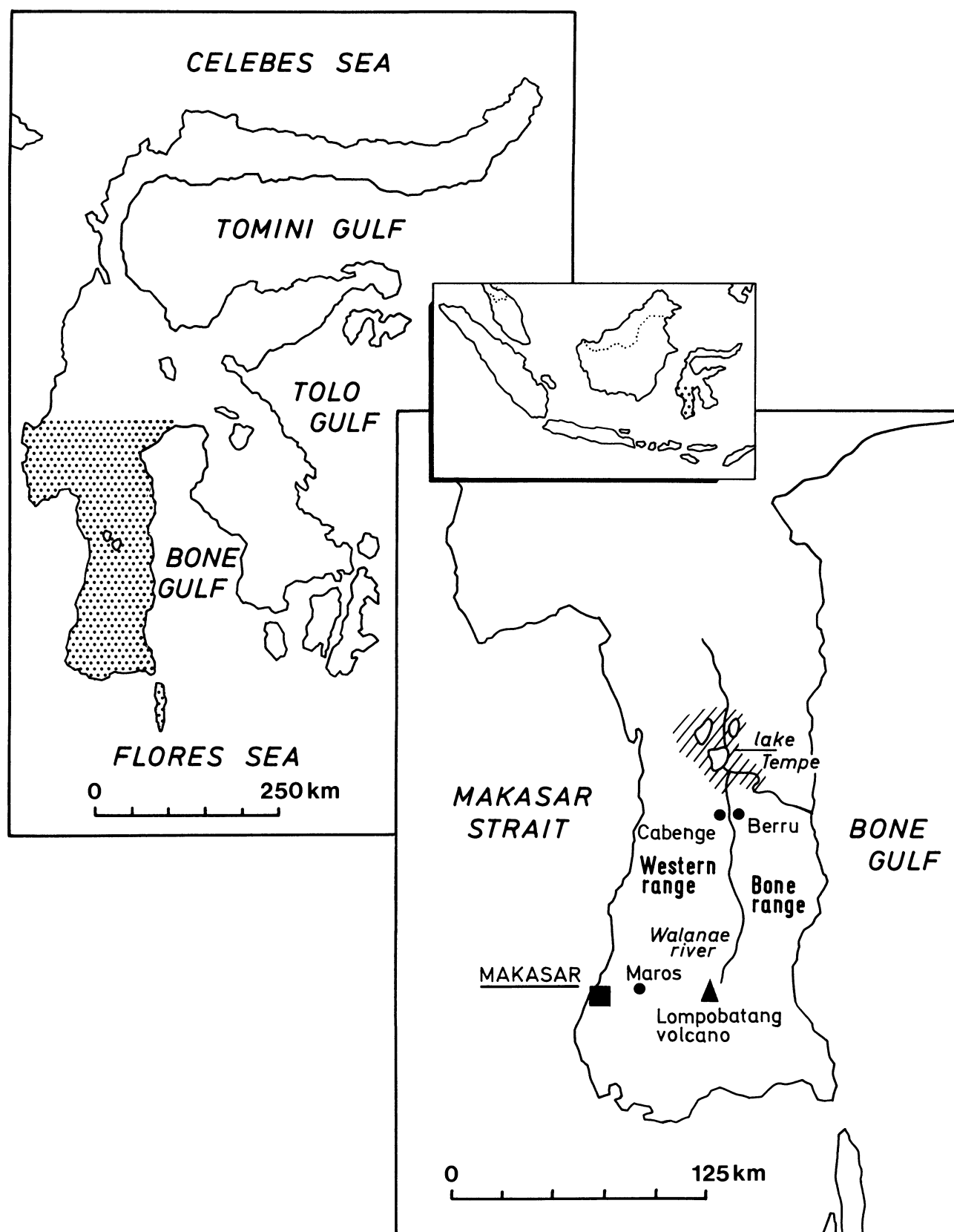


FIG. 1. *Sulawesi (left) and its south arm, showing principal sites (right).*

Celebochoerus fauna in South Sulawesi as, for example, does Hooijer (1975); all of the species found could have reached the former island by swimming—even the elephants (Sondaar 1981).

The Swiss naturalists Sarasin and Sarasin (1901) described thick deposits of clay, sand, and gravel in the broad Walanae Valley that they called "Celebes molasse." The Dutch mining engineers 't Hoen and Ziegler (1917 [1915]) made this molasse part of the so-called Walanae or Bone Formation, which outcrops at various places in the central part of the south arm in the form of cemented sandstones and conglomerates. Erosion of these exposures results in sheets of lag gravel that cover the slopes of the hills. It was in such gravels that the first vertebrate fossils were found, but later investigations have uncovered numerous fossils *in situ* in the hard rock of the Walanae Formation. These vertebrate-bearing deposits have been examined in the field (Sjahroel 1970, Bartstra 1977, Sartono 1979). The Walanae Formation represents a regressive sequence with a distinct coarsening upwards that is suggestive of the gradual filling-up of a previous basin between the western and eastern mountain ranges of South Sulawesi, with sections revealing marine deposits at the base and subsequently exhibiting neritic through littoral to estuarine deposits at the top. Intercalated tuff deposits, pointing to contemporaneous volcanic activity, can be observed. The vertebrate fossils are to be found in the very top parts of the sections, and, as one would expect, the larger fossils (complete elephant skulls) occur in the sandstone and the smaller, stronger fragments in the conglomerates.

Sartono (1979) assigns a Pliocene age to all the vertebrate fossils of the Walanae Formation, as do Hooijer (1982) and Groves (1985). We think that a Pleistocene age cannot be excluded for the specimens at the very top, directly southwest and southeast of Lake Tempe. The shallowing of the basin would have been a long, intermittent process beginning in the Upper Miocene and continuing well into the Pleistocene, culminating in a final uplift of the area with subsequent subaerial erosion. Attempts at uranium-series dating (in Groningen in 1987) of some of the fossil vertebrate fragments found *in situ* in the top part of the Walanae Formation (near Paroto) point to ages in excess of 350,000 years.

No remains of early hominids have ever been discovered amongst the numerous vertebrate fragments from South Sulawesi. Stone artifacts have been found, however, at precisely the same localities as the vertebrates.

The first artifacts from the Walanae Valley were found by Olivier, a Dutch agriculturalist, on August 2, 1947. Olivier mentioned these finds to van Heekeren, who subsequently managed to find more, mostly around the village of Berru on the right bank of the Walanae. Van Heekeren (1958) classified these artifacts as belonging to the Cabenge (formerly Tjabenge) industry, named for the nearest town.

Van Heekeren always thought that the fossil vertebrates of South Sulawesi and the artifacts of the Cabenge

industry were of the same age. This explains to some extent the great enthusiasm with which he continued his research in the Walanae Valley during those politically turbulent and dangerous times. He was informed by Hooijer that the fossil vertebrates were very old, and because tools and artifacts were found together there was the possibility that *H. erectus* has been the manufacturer. If remains of *H. erectus* could be found, they would represent its first occurrence in island Southeast Asia outside of Java.

Van Heekeren (1972) identified in the area around Berru a system of seven terraces, the oldest very eroded (recognizable in "kopjes") and the youngest taking the form of extensive clay deposits immediately bordering the river. Although terraces definitely exist, however, on the basis of height alone no more than three or four can be recognized (Bartstra 1977, Sartono 1979). The two highest, the 75-m and 50-m treads, are recognizable in extensive gravel sheets, a phenomenon that can also be observed in the terrace systems of the larger rivers of Java and is to be explained by the disappearance of the finer clastics at the higher levels as a result of erosion over a period of centuries. In many places, and typically in the Berru area, these terrace gravels have become mixed with lag gravels of the weathering conglomerates in the top part of the Walanae Formation. Since these conglomerates are fossil bearing, fragments of vertebrates appear in the lag gravels, in the mixed terrace/lag gravels, and occasionally also in the terrace gravels proper (because at the time of the accumulation of the high terraces the river was eroding the Walanae Formation). Artifacts of the Cabenge industry can only be found in the terrace gravels and are therefore much younger than the fossil vertebrates. Although differences in the interpretation of the local section around Berru have been voiced by Sjahroel (1970), Bartstra (1977), and Sartono (1979), all three agree on the non-contemporaneity of the fossils and the artifacts.

Several attempts have been made to determine the age of the Cabenge artifacts more precisely, for instance, by assigning an age to the Walanae terraces. Sartono (1979) merely indicates a Pleistocene age, but Sjahroel (1970) points to the Upper Pleistocene in particular. On geomorphological grounds we also favour an Upper Pleistocene age. A terrace system has developed on both sides of the Walanae along its middle course, and it can clearly be connected with the present drainage network. Part of this terrace system has been eroded away, but unconsolidated terrace fills are still preserved at high levels. In view of the rate of denudation these cannot be older than Upper Pleistocene at the most.

In 1970 three small excavations were carried out in the environs of Berru in remnants of the 75-m and 50-m terraces. Beneath the loose top gravels, finer clastics can sometimes be located in the form of stream-laid sands and clays. This whole sequence of local alluvium, unconformably overlying the Walanae Formation, is as thick as 2 m in some places. From this alluvium a few fragments of vertebrates have been collected, but, as we

have said, these are probably derived from the Walanae Formation and are therefore of little use for relative dating (if indeed this were possible with an impoverished endemic fauna). Naturally, the possibility cannot be excluded that some fossil fragments are autochthonous, in which case they would be contemporary with the accumulation of the high terrace fills. This would mean that the *Archidiskodon-Celebochoerus* fauna survived into the Upper Pleistocene, until the arrival of humans, but so far there is no evidence for this.

It must be emphasized that the excavations of 1970 did not provide any conclusive evidence that stone artifacts occur *in situ* in the high terrace gravels or finer clastics. Their distribution was not uniform, the finds appearing to be concentrated on the surface of the high westward-protruding edges of the 75-m and 50-m levels. It looked as if people occupied and manufactured their implements on terrace treads already in existence, and this general impression has not basically changed as a result of reconnaissance trips and the digging of new test pits (albeit small ones) in the Berru area in 1978 and thereafter.

In a preliminary recapitulation of the 1978 fieldwork, the artifacts from the Walanae Valley were divided into three groups (assemblages). In making this classification it was assumed, on the basis of heavy patination and fluvial wear (which do not appear to be related to the raw material used), that the oldest group is in primary context in the terrace gravel, although again there is no direct evidence of this from the test pits (Bartstra 1978). In our opinion this postulated occurrence *in situ* is justified by the pronounced differences in rounding in the collection. The number of artifacts attributable to this first group is small, however. A second group actually does occur only on the surface and appears to fit the above-mentioned distribution pattern. A third group is associated with Post-Pleistocene "microlithic" sites that have no connection with the Walanae River terrace system.

Thus the first group of artifacts could be the same age as the gravels of the 75-m and 50-m levels. It would be of great interest if it should prove contemporaneous with one of the migration waves postulated by Thiel of *H. sapiens* across Wallace's Line during a period of distinct rise in sea level around 60,000 or 45,000 years B.P. There is still no substantial evidence for this, but it is interesting that the second group of artifacts is morphologically not unlike the Upper Pleistocene Leang Burung 2 cave industry, for which the oldest C^{14} determinations go back to ca. 30,000 B.P. (Glover 1981 and personal communication).

The Cabenge artifacts can be roughly grouped as cores, flakes, and unifacial and bifacial pebble and cobble artifacts (so-called choppers and chopping-tools). Classification within the latter group is based on size and pattern of flake removal. A diameter smaller or larger than 64 mm may be regarded as a criterion for a distinction between pebble and cobble artifacts (with reference to the Wentworth [1922] scale). This categorization is devoid of specific functional interpretations (e.g., "chop-

per") and provides an opportunity to shape a more objective framework for lithic analysis (Keates and Bartstra n.d.). The raw material for the Cabenge specimens derives from river gravels of many types (andesite, quartzite, chert, silicified tuff, and limestone). While the large artifacts were made of relatively coarse-grained materials, the small ones were primarily made of fine-grained ones, and this appears to indicate selection of particular raw materials for different lithic classes. Conclusive functional identification of the Cabenge artifacts is hampered by natural wear and, to some extent, by the method of core reduction (direct hard-hammer percussion), which makes clear identification of possible use-wear problematic in a number of cases. The lack of subsistence evidence, for example, animal bones with cut-marks, in association with the specimens further complicates an assessment of palaeoeconomic behaviour in the Walanae Valley. Judging from the distribution of small flake scars, however, some of the artifacts, particularly the flakes, may have been used as scraping and/or cutting tools.

To place the Cabenge industry in a wider archaeological context we can examine the Maros limestone region, southwest of Cabenge, which has a good prehistoric record from the Upper Pleistocene well into the Holocene (Bellwood 1985). Three limestone caves that have been studied have a chronological though interrupted record from around 30,000 years B.P. to 2,000 years B.P. No significant change in stone artifact technology can be observed until about 7,000 years B.P., but a trend towards smaller tools has been noted (Presland 1980). Leang Burung 2 (ca. 31,000–ca. 19,000 years B.P.), although the oldest, has not yielded any bifacial cobble artifacts (Glover 1981). This suggests that these types in the first group of the Cabenge industry together with the worn flakes may represent the earliest record of human occupation in South Sulawesi. Alternatively, of course, they may indicate different adaptive strategies in the Walanae Valley area.

Outside Sulawesi, the artifacts from Ngebung and Tapan (both within the dome of Sangiran in Central Java) are very different from the Cabenge specimens. They date from the basal Upper Pleistocene and are probably the work of *H. erectus soloensis* (Bartstra 1990 [1989], Bartstra and Basoeki 1989). The only artifacts from Central Java that have been assigned to the second half of the Upper Pleistocene and connected with *H. sapiens* are those of the so-called Pacitanian (Bartstra 1984), a genuine techno-complex with an abundance of pebble and cobble tools, mostly unifacial. Characteristic elements are the so-called hand-adzes and hand-axes, although these latter differ from the classic *limande* concept in Western Europe. In the Cabenge industry there are also "hand-adzes" and "hand-axes"; while we do not favour a functional terminology for the Cabenge specimens, a morphological description may obscure their distinct correspondence with Pacitanian types.

Summarizing, then, in our opinion the Cabenge industry of South Sulawesi is to be linked with the first waves of *H. sapiens* that crossed Wallace's Line in the second

half of the Upper Pleistocene: the Cabengian and the Pacitanian are of the same family.

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On Archaeology and Folk Archaeology: A Reply

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Cole, Feder, Kehoe, and Harrold and Eve (CA 31:390-94) question my claims (CA 31:103-7) regarding the reaction of the professional archaeological community to folk archaeology in the United States. Several positions are mistakenly attributed to me by these critics. I do not claim, as Cole suggests, that there is a conspiracy on the part of the professional archaeological community to silence folk believers. Nor do I claim that all ideas are equal. While Harrold and Eve suggest that the sort of analysis I call for has been done by several researchers whom I overlook, in fact I do cite some of this work and state unequivocally (p. 104) that archaeologists "have available to them both objective studies of folk beliefs and overwhelming evidence of the culturally interconnected nature of popular conceptions of the past."

Feder characterizes folk-archaeology critics such as himself as a beleaguered minority that cares "passionately about the past" and is performing a valuable service in combatting "dangerous nonsense." Cole sees himself and his colleagues in a lonely battle against the forces of politicized pseudoscience and me as attacking "people who have worked to defend public-school teachers against pressure from the so-called scientific-creationist camp." This loaded language simply reinforces my contention that some archaeologists have cast themselves in the role of social guardians. To be sure, as Feder asserts, only a minority is active in this area; however, this minority is responsive to the ideal needs that archaeologists carry with them as professionals, alert in a variety of ways to the expectations of a larger American society that sometimes demands practical results for the money it spends on science. Fighting the dangers of science illiteracy, racism, and dangerous ideas would seem to qualify as practical.

Cole and Feder emphasize that they are proud to be associated with science and scientists. Harrold and Eve imply that I consider science in archaeology to be folly. Naturally, I never suggested anything of the kind, and I do not see anything wrong with science in archaeology or with the scientific method. The application of scientific techniques and interdisciplinary work with scientists are obviously essential to modern archaeology. However, it is not a coincidence that archaeologists contrast themselves with nonscientists at the same time the national media, government agencies, and a variety of think tanks are calling for more science education. Archaeologists associate their discipline with science not only because science is useful in archaeology but because science in modern pluralistic and secular America is respected as an impartial avenue to truth. As